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ABSTRACT

A paper-and-pencil test consisting of a series of 24 sketches was administered to assess the performance of hearing impaired students aged 9-12 on a Piagetian horizontality task. This age range among hearing students is the developmental period during which comprehension of the principle of horizontality should begin to emerge, indicating ability to use external frames of reference to accurately represent objects. To compare results of similar studies using hearing subjects, the effect of gender and the shape of the water container (curved versus straight-sided) on the performance of seven male and eight female hearing impaired students from a residential school was examined. Ss were selected from among students with a pure-tone hearing loss of 92 dB or greater. Results yielded significant main effects of bottle shape and bottle position. Males were found to perform better than females on some few item subsets. Among a number of conclusions drawn was that hearing impaired children can begin to appropriately represent spatial relationships at an early age, but need practice in learning to disregard distracting spatial cues. (JW)

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Hearing Impaired Children's Performance on the Piagetian Liquid Horizontality Test

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HEARING IMPAIRED STUDENTS' PERFORMANCE ON A PIAGETIAN HORIZONTALITY TASK

INTRODUCTION

Numerous studies have been conducted to assess patterns of cognitive development in children. One skill considered important by Piaget and Inhelder (1956) in the developmental sequence is the child's ability to understand the principle of liquid horizontality, or the idea that still water remains invariantly level regardless of the angle of the container. Comprehension of this principle taps the child's ability to utilize external frames of reference to accurately represent objects in space.

Studies with hearing subjects have indicated that females appear to have considerably more difficulty with the horizontality principle than males (e.g., Rebelsky, 1964; Morris, 1971; Williamson and Reynolds, 1973; Kelly and Kelley, 1977; Kelly and Witters, 1981). Hearing subjects, in general, have also been found to perform better on the horizontality task if the water containers are depicted with curved rather than more perceptually distracting straight sides (e.g., Williamson and Reynolds, 1973; Walker and Kransnoff, 1978).

Several investigators have studied acquisition of the horizontality principle among secondary level hearing impaired students (e.g., Murphy-Berman, Witters and Harding, 1983; Witters-Churchill, Kelly and Witters, 1983). These studies indicated that container shape had a similar impact on students' task performance as in the hearing samples. Unlike results with hearing subjects, however, consistent pattern of sex differences

have not been reported among the hearing impaired students.

In the present study the effect of students' gender and the shape of the water container (curved versus straight sided) on primary aged hearing impaired students' performance on the horizontality task was assessed. This is an important age group to study because it is during this developmental period that comprehension of horizontality should just begin to emerge.

DESIGN

The subjects for this study consisted of seven (7) male and eight (8) female hearing impaired children from a residential school. The children's ages ranged from 9-12 with a mean age of 10.73. The subjects were selected from among students with a pure-tone hearing loss of 92 dB or greater. The students had been previously identified by school records as being within the normal range of intelligence and their reading levels ranged from second to fourth grades.

The measure for assessing the subjects' perception of liquid horizontality was a paper and pencil test with a series of sketches of 24 bottle shapes, 12 rectangular and 12 curved, drawn analogous to hourly clock positions. The liquid horizontality test modification and the scoring criteria were identical to those described in detail elsewhere (Kelly and Kelly, 1977). To minimize misunderstanding, the assessment tool was administered by a teacher of the hearing impaired fluent in American Sign Language.

FINDINGS/IMPLICATIONS

Separate mixed model analyses of variance were performed for the summed

scores for the oblique and horizontal/vertical bottle positions. For the oblique items, a 2 (male/female) x 2 (bottle shape) x 8 (bottle position) analysis was performed. For the horizontal/vertical items, a 2 (male/female) x 2 (bottle shape) x 4 (bottle position) analysis was computed. The last two factors in both analyses were repeated factors and the first variable was a grouping factor. The results of the analysis yielded significant main effects of bottle shape (straight sided containers induced more errors than curved sided containers) and bottle position (early items were more difficult than later items). Also, males were also found to perform better than females on some few item subsets.

Several conclusions can be drawn from the data. The pattern of findings for bottle shape were quite similar to those found with populations of secondary level hearing impaired students, suggesting that the primary-level deaf youngster may process this type of spatial transformation in a manner quite similar to their older peers. Bottle shape was also found to affect hearing students' performance on this type of task in a similar manner (e.g., Williamson and Reynolds, 1973; Walker and Krasnoff, 1978), suggesting that the cue value of the container shape operates in the same way for the hearing and hearing impaired youngsters.

The pattern of sex differences found in this investigation also lends support to findings from previous studies with the hearing impaired. Although here males were found to perform slightly better than females on some question subsets, on the majority of items no significant sex differences were reported. Perhaps hearing impaired students' reduced linguistic

sophistication shields him or her from assimilating some of the subtle sex biases present in the language that may depress hearing females' performance on spatial tasks. These data also suggest that the consistent pattern of sex differences found with hearing students may have more of a social/experiencial than a biological basis.

The findings further have several interesting instructional implications. Organizing the relationship of objects in space is key to the study of a variety of academic subjects such as geography and mathematics and requires an ability to utilize spatial reference cues. Our data suggests that hearing impaired children can begin to appropriately represent spatial relationships at an early age, but need practice in learning to disregard distracting spatial cues.

Providing an environment in which learners can problem solve and self-regulate their own learning would appear desirable (Copeland, 1979). This self-paced instruction suggests more inductive approaches to teaching and learning, in which students acquire understanding of concepts through personal discovery and through working with concrete objects and materials. Such an approach may lay a ground work that would help students comprehend more abstract spatial principles encountered later in subjects like physics, geography, and geometry.

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